

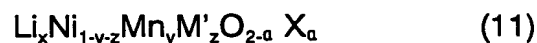
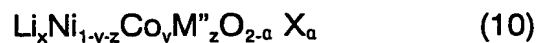
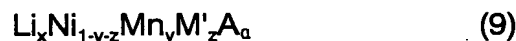
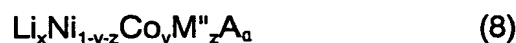
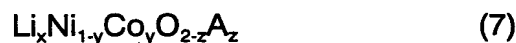
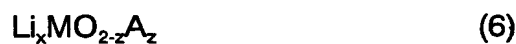
WHAT IS CLAIMED IS:

1. A positive active material for a rechargeable lithium battery comprising

a core comprising at least one lithiated compound; and

5 a surface-treatment layer on the core comprising at least one coating material selected from the group consisting of coating element included-hydroxides, oxyhydroxides, oxycarbonates, hydroxycarbonates and a mixture thereof.

2. The positive active material of claim 1 wherein the lithiated
10 compound is at least one lithiated compound represented by the formulas 1 to 11,



where

$$0.95 \leq x \leq 1.1, 0 \leq y \leq 0.5, 0 \leq z \leq 0.5, 0 \leq a \leq 2,$$

M is Ni or Co,

M' is at least one element selected from the group consisting of Al, Ni, Co, Cr, Fe, Mg, Sr, V, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No and Lr,

M" is at least one element selected from the group consisting of Al, Cr, Mn, Fe, Mg, Sr, V, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No and Lr,

A is selected from the group consisting of O, F, S and P, and

X is selected from the group consisting of F, S and P.

3. The positive active material of claim 1 wherein the coating element of the coating material is soluble in organic solvents or water.

4. The positive active material of claim 3 wherein the coating element of the coating material is at least one element selected from the group consisting of Mg, Al, Co, K, Na, Ca, Si, Ti, Sn, V, Ge, Ga, B, As, Zr, and a mixture thereof.

5. The positive active material of claim 1 wherein the coating material has amorphous or crystalline form.

6. The positive active material of claim 1 wherein the surface-treatment layer has a thickness in the range of 0.1 to 300nm.

7. The positive active material of claim 6 wherein the surface-treatment layer has a thickness in the range of 0.1 to 100nm.

8. The positive active material of claim 7 wherein the surface-

treatment layer has a thickness in the range of 0.1 to 50nm.

9. The positive active material of claim 1 wherein the content of the coating element of the coating material is 2×10^{-5} to 2 percent by weight based on the weight of the positive active material.

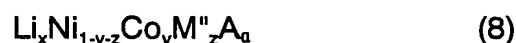
10. The positive active material of claim 9 wherein the content of the coating element of the coating material is 0.001 to 2 percent by weight based on the weight of the positive active material.

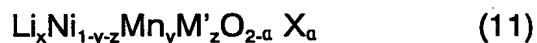
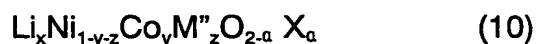
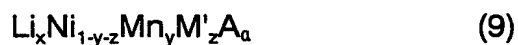
11. A method of preparing a positive active material for a rechargeable lithium battery comprising:

coating at least one lithiated compound with an organic solution of coating material source or an aqueous solution of coating material source to produce a coated compound; and

drying the coated compound.

12. The method of claim 11 wherein the lithiated compound is at least one lithiated compound represented by formulas 1 to 11,





where

$$0.95 \leq x \leq 1.1, 0 \leq y \leq 0.5, 0 \leq z \leq 0.5, 0 \leq a \leq 2,$$

M is Ni or Co,

M' is at least one element selected from the group consisting of Al, Ni, Co, Cr, Fe, Mg, Sr, V, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No and Lr,

M'' is at least one element selected from the group consisting of Al, Cr, Mn, Fe, Mg, Sr, V, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No and Lr,

A is selected from the group consisting of O, F, S and P, and

X is selected from the group consisting of F, S and P.

13. The method of claim 11 wherein the organic solution of coating material source is prepared by adding a coating material source to an organic solvent to form a mixture, the coating material source being selected from the group consisting of a coating element, a coating element included-alkoxide, salt and oxide.

14. The method of claim 13 wherein the mixture is refluxed to form the organic solution of coating material source.

15. The method of claim 11 wherein the aqueous solution of coating material source is prepared by adding a coating material source to

water to form a mixture, the coating material source being selected from the group consisting of a coating element included-salt and oxide.

16. The method of claim 15 wherein the mixture is refluxed to form the aqueous solution of coating material source.

5 17. The method of claim 11 wherein the organic solution of coating material source is formed from a coating element that is soluble in organic solvents, and

the aqueous solution of coating material source is formed from a coating element that is soluble in water.

10 18. The method of claim 17 wherein the coating element of the coating material source is at least one element selected from the group consisting of Mg, Al, Co, K, Na, Ca, Si, Ti, Sn, V, Ge, Ga, B, As, Zr, and a mixture thereof.

15 19. The method of claim 11 wherein the concentration of coating material source in the organic solution or aqueous solution is 0.1 to 50 percent by weight.

20. The method of claim 19 wherein the concentration of coating material source in the organic solution or aqueous solution is 5 to 30 percent by weight.

20 21. The method of claim 11 wherein the coating step is performed by injecting the lithiated compound and the organic solution or the aqueous solution of coating material source into a mixer and continuously increasing the temperature within the mixer.

22. The method of claim 21 wherein the coating step further comprises injecting blowing gas into the mixer.

23. The method of claim 21 wherein the coating step is performed under a vacuum.

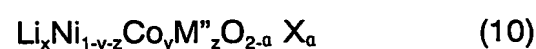
24. The method of claim 10 further comprising sieving the dried coated compound.

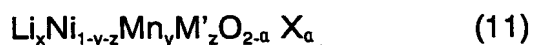
25. A positive active material for a rechargeable lithium battery comprising

a core comprising at least one lithiated compound; and

a surface-treatment layer on the core comprising coating element-included-hydroxide or oxyhydroxide.

26. The positive active material of claim 25 wherein the lithiated compound is at least one lithiated compound represented by formulas 1 to 11,





where

$$0.95 \leq x \leq 1.1, 0 \leq y \leq 0.5, 0 \leq z \leq 0.5, 0 \leq a \leq 2,$$

M is Ni or Co,

5 M' is at least one element selected from the group consisting of Al, Ni, Co, Cr, Fe, Mg, Sr, V, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No and Lr,

M'' is at least one element selected from the group consisting of Al, Cr, Mn, Fe, Mg, Sr, V, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm,
10 Yb, Lu, Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No and Lr,

A is selected from the group consisting of O, F, S and P, and

X is selected from the group consisting of F, S and P.

27. The positive active material of claim 25 wherein the coating element of the surface treatment layer is soluble in organic solvents or water.

~ 15 28. The positive active material of claim 25 wherein the coating element of the surface treatment layer is at least one element selected from the group consisting of Mg, Al, Co, K, Na, Ca, Si, Ti, Sn, V, Ge, Ga, B, As, Zr, and a mixture thereof.

29. The positive active material of claim 25 wherein the coating
20 material has amorphous or crystalline form.

30. The positive active material of claim 25 wherein the content of the coating element of the surface-treatment layer is 2×10^{-5} to 2 percent by weight based on the weight of the positive active material.

31. The positive active material of claim 30 wherein the content of the coating element of the surface-treatment layer is 0.001 to 2 percent by weight based on the weight of the positive active material.

32. A positive active material for a rechargeable lithium battery comprising:

a core comprising a lithium-cobalt chalcogenide compound; and

a surface-treatment layer on the core comprising $\text{Al}(\text{OH})_3$ or, $\text{AlO}(\text{OH})$.

33. The positive active material of claim 32 wherein the content of Al of the surface-treatment layer is 2×10^{-5} to 2 percent by weight based on the weight of the positive active material.

34. The positive active material of claim 33 wherein the content of Al of the surface-treatment layer is 0.001 to 2 percent by weight based on the weight of the positive active material.

35. A positive active material for a rechargeable lithium battery comprising:

a core comprising a lithium-manganese or lithium-cobalt chalcogenide compound; and

a surface-treatment layer on the core comprising $\text{HB}(\text{OH})_2$.

36. The positive active material of claim 35 wherein the content of B of the surface-treatment layer is 2×10^{-5} to 2 percent by weight based on the weight of the positive active material.

37. The positive active material of claim 36 wherein the content of B of the surface-treatment layer is 0.001 to 2 percent by weight based on the

weight of the positive active material.